

November 1991

## BEST PRACTICE PROGRAMME

# 7198

# Good Practice Guide

# 19

**A Strategic Guide for:  
Local Authority Managers and  
Elected Members**

**REFURBISHMENT**

**OF POST-WAR**

**LOW RISE**

**HOUSING**



**Energy Efficiency Office**  
DEPARTMENT OF THE ENVIRONMENT

**M2  
R5  
C1/Sfb 1976 81 Y7**



# **Good Practice Guide**

## **A STRATEGIC GUIDE**

**for:**

**Local Authority Managers**

**on**

**Post War Low Rise Housing**

**WHY**

**SAVE ENERGY**

**WHAT**

**TO DO ABOUT  
ENERGY SAVING**

**HOW**

**TO SELECT  
ENERGY MEASURES**

**WHEN**

**TO APPLY ENERGY  
SAVING MEASURES**

**WHO**

**TO CONTACT FOR  
FURTHER ADVICE**

# ENERGY EFFICIENT DWELLINGS

- **CAN BENEFIT YOUR AUTHORITY**

By being easier to maintain and easier to let, with less risk of litigation from dissatisfied tenants.

- **CAN BENEFIT YOUR TENANTS**

By being more comfortable to live in and having lower fuel costs and a healthier environment.

- **CAN BENEFIT THE NEIGHBOURHOOD**

By an improved appearance, thereby increasing local pride.

- **CAN BENEFIT THE COUNTRY**

By reducing the demand for fuel and consequently helping to conserve the non-renewable fossil fuels.

- **CAN BENEFIT THE ENVIRONMENT**

By reducing pollution (eg acid rain, CO<sub>2</sub> emissions) associated with energy supplies.

**WHY SAVE ENERGY****ENERGY EFFICIENT HOUSES**

- provide 'affordable warmth' for low income households, to achieve temperature levels of 21°C in the living areas and 18°C in the rest of the house.
- are more comfortable, are easier to heat and have more satisfied tenants.
- are warmer and easier to let.
- have lower heating bills leaving the tenant with more money for the rent.
- reduce condensation risks and are healthier for tenants.
- can stay warmer longer or can heat up quicker.
- have less draughts particularly from windows and doors.
- have better ventilation systems.
- reduce maintenance costs by keeping the building structure in better condition.
- can improve the appearance of estates with external insulating measures.
- can cost up to 15% more than ordinary modernisation but savings can be made through installing a cheaper heating system, and from future maintenance costs and rent adjustments.

**WHAT TO DO ABOUT ENERGY SAVING**

The dwelling types we are concerned with in this Guide are POST WAR LOW RISE HOUSES AND FLATS.

The English House Condition Survey identified over 1.4 million dwellings in England and Wales occupied by low income families in the following house types:

- Semi detached and terraced two storey houses.
- Two and three storey flats.
- Four and five storey flats and maisonettes.
- Low rise high density types — commonly deck access.

The particular energy efficient upgrading measures that are available for the most common construction types of these dwellings are described briefly on the following pages.

## POST WAR LOW RISE HOUSING

### TRADITIONAL



#### CONSTRUCTION

Cavity Walls.  
Pitched roof.  
Solid or timber ground floor.  
Metal or timber windows.  
Various heating systems.

#### CHARACTERISTICS

Condition of structure usually good.  
Maintenance standard variable.  
Many need modernisation and some schemes need area upgrading.  
Often high proportion now in owner occupation.

#### DWELLING TYPES

Detached.  
Semi-detached.  
Terraced.  
Flats and maisonettes.

#### RELEVANT ENERGY EFFICIENCY MEASURES

- insulate external walls with cavity fill, external or internal insulation.
- insulate loft with 150mm insulation.
- draught proof
- provide controlled ventilation
- provide efficient heating system

### CROSSWALL



#### CONSTRUCTION

Cavity gable walls, infill panels front and back.  
Pitched or flat roof.  
Solid or timber ground floor.  
Metal or timber windows.  
Various heating systems.

#### CHARACTERISTICS

Condition of brick structure usually good.  
Infill panels may be deteriorating particularly at sills and at ground level.  
Very large windows common.  
Many will need modernisation.  
Many will be in owner occupation.

#### DWELLING TYPES

Detached.  
Semi-detached.  
Terraced.  
Flats or maisonettes.

#### RELEVANT ENERGY EFFICIENCY MEASURES

- insulate gables with cavity fill, external or internal insulation.
- insulate loft with 150mm insulation or repair/insulate flat roof.
- draught proof
- provide controlled ventilation
- provide efficient heating system
- insulate infill panels reducing size of large windows.

### NO FINES CONCRETE



#### CONSTRUCTION

Solid walls.  
Pitched or flat roof.  
Solid ground floor.  
Metal or timber windows, commonly electric under-floor or storage heating.

#### CHARACTERISTICS

Structure usually good but internal wall linings and external renderings may be deteriorating.  
Maintenance variable.  
Many need modernisation and some need area upgrading.  
Difficult to insert fixings in walls.

#### DWELLING TYPES

Semi-detached.  
Terraced.  
Flats.

#### RELEVANT ENERGY EFFICIENCY MEASURES

- insulate external walls with external or internal insulation.
- insulate loft with 150mm insulation.
- draught proof
- provide controlled ventilation
- provide efficient heating system



### PREFABRICATED REINFORCED CONCRETE



#### CONSTRUCTION

Concrete frame with concrete cladding panels.  
Flat or pitched roof.  
Solid ground floor.  
Metal windows.  
Various heating systems.

#### CHARACTERISTICS

Concrete frames subject to deterioration due to reinforcement corrosion. Although most have no immediate structural problems they are not considered suitable for mortgage purposes. May need modernisation including area upgrading when PRC Homes approval should be considered.

#### DWELLING TYPES

Semi-detached.  
Terraced.  
Flats and maisonettes.

#### RELEVANT ENERGY EFFICIENCY MEASURES

- insulate walls with external or internal insulation or replace concrete panels with brickwork.
- insulate pitched roofs with 150mm insulation.
- construct pitched roof over flat roof (and insulate with 150mm insulation) or repair/insulate flat roof.
- draught proof
- provide controlled ventilation
- provide efficient heating system

### CONCRETE FRAME & INFILL



#### CONSTRUCTION

Concrete frame with brickwork between the frames.  
Flat roof.  
Solid ground floor.  
Metal or timber windows.  
Various heating systems but commonly electric underfloor or storage heating.

#### CHARACTERISTICS

Condition of structure usually good although may be subject to reinforcement corrosion. Some require modernisation. Maintenance is variable. Often have condensation on the concrete frames.

#### DWELLING TYPES

5 storey flats/maisonettes.  
Low rise high density deck access.

#### RELEVANT ENERGY EFFICIENCY MEASURES

- insulate walls with external insulation.
- repair/insulate roof.
- construct pitched roof over flat roof (and insulate with 150mm insulation).
- draught proof
- provide controlled ventilation
- provide efficient heating system

### TIMBER FRAME



#### CONSTRUCTION

Timber framed structural walls with weather boarding or brick external skin.  
Pitched roof.  
Timber ground floor.  
Timber windows.  
Various heating systems.

#### CHARACTERISTICS

Some older timber framing may be affected by rot. External timber weather boarding may be deteriorating. Many need modernisation. Some may be in owner occupation.

#### DWELLING TYPES

Detached.  
Semi-detached.  
Terraced.

#### RELEVANT ENERGY EFFICIENCY MEASURES

- insulate within the frame with 100mm insulation.
- insulate loft with 150mm insulation.
- draught proof
- provide controlled ventilation
- provide efficient heating system

## POST WAR LOW RISE HOUSING

In addition to the measures indicated the following measures should be considered for all types:

- insulate ground floors.
- replace windows with double glazed units.
- provide porch/vestibule.

### HOW TO SELECT ENERGY EFFICIENCY MEASURES

The best way forward would be to develop an 'affordable warmth' programme that addresses and provides answers to the following questions:

- What can tenants afford to spend on fuel?
- What target should be set on heating costs?
- How far does the stock fall short of the set target?
- How to select energy efficiency measures to cost effectively meet the set target?

### ADVICE TO TENANTS AND OCCUPIERS

Tenants should be consulted before modernisation either in the tenant/landlord relationship or as important participants in a community action programme. It will be necessary to illustrate at that consultative stage the imperative need to upgrade the energy efficiency of the dwellings:

- to reduce condensation.
- to improve comfort standards.
- to reduce annual running costs.
- to maintain the dwelling in good condition.
- and to contribute to safeguarding the global environment.

It is important to achieve a complete package of energy measures, since partial upgrading can lead to problems elsewhere.

As there will be priorities to be selected from competing demands on limited budgets, these issues must be presented in an easy to understand way.

A full energy upgrading package will also be required to be explained in detail to tenants not only immediately after completion but also in follow-up visits, covering:

- The control of the heating system.
- The setting of thermostats and/or radiator valves.
- The control of ventilation — mechanical in kitchens and bathrooms and trickle vents in other rooms.
- The action to take when washing and drying clothes and when cooking.

Tenants must be assisted in understanding how to deal with these issues. This is particularly important for low income families, and for the elderly and the disabled. If the system is too difficult to understand they may either incur bills beyond their ability to pay or they will not use the heating and the dwelling will return to being cold and damp.

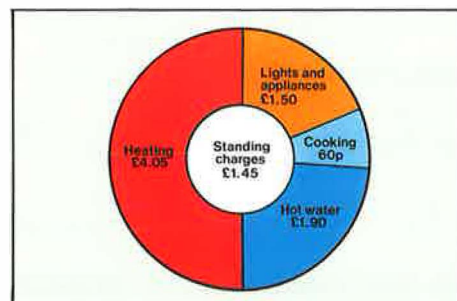
**Table 1** Average weekly spending on fuel, light and power by low income council tenants (from 1988 Family Expenditure Survey)

Type of household	As % of all council tenants	Average weekly spending	Spending on fuel, light and power	Fuel, light and power as % of income
Single person families				
pensioners	21%	£50.58	£6.84	14%
non-pensioners	7%	£53.21	£7.07	13%
Other families without children				
pensioners	10%	£85.59	£9.18	11%
non-pensioners	5%	£88.49	£9.96	11%
Families with children				
single parent and child	4%	£65.93	£9.43	14%
single parent with children	4%	£88.27	£11.50	13%
others with children	9%	£120.49	£11.93	10%

**Note:** the above figures are not just for heating alone. They are for expenditure on all fuel, light and power in the home.

### WHAT CAN TENANTS AFFORD

Family Expenditure Survey figures for expenditure on fuel light and power for households on low income are given in Table 1. The Family Expenditure Survey does not identify expenditure on heating separately from other uses of fuel. In this Guide figures have been used from a very detailed study which took place in Birmingham in the early 1980's (The EIK Study). A breakdown between different fuel uses is given below.



The Diagram shows spending on fuel light and power by seven low income two person households, (1990 prices).

### SETTING A TARGET FOR IMPROVEMENT

It is suggested that reasonable targets to adopt might be those set out in Table 2. An explanation of how these targets were set is given in the Best Practice programme Energy Consumption Guide 5.

**Table 2** Target costs for heating, at 1990 prices and design heat loss targets with gas heating

Dwelling size	Target £/week	running costs £/year
bedsitters & 1 Bedroom	£2.40	£125
2 Bedroom	£3.50	£180
3 Bedroom	£4.50	£235

### Insulation

So having set target running costs, what is the insulation standard that will achieve an acceptable level of warmth when expenditure on heating is limited to this amount?

This calculation can be done using the Building Research Establishment Domestic Energy Model (BREDEM) based software such as Energy Targeter or Energy Label programs from the National Energy Foundation (NHER Evaluator) and Starpoint. There has to be two sides to the target. Firstly insulating the houses and secondly installing good modern heating systems. Energy Targeter and NHER Evaluator allow the user to put in their own cost information for different types of insulation and heating systems, and so evaluate the most cost effective way of meeting the target. Both programs also allow a simple assessment of the condensation risk as part of the evaluation process.

### HOW FAR DOES YOUR STOCK FALL SHORT OF THE TARGET

Having set targets, and having set standards for insulation and heating systems, the next step is to make an analysis of the housing stock and compare the calculated heat losses with the targets.

The information to be collected from an energy survey would include:

- the materials and type of construction of walls, roof, floors, windows, doors and other external elements.
- the presence, of any insulating measures, eg loft insulation, cavity insulation, draughtstripping, double glazing.
- the areas of walls, windows, roofs, etc sufficiently accurately to enable heat losses to be calculated.
- the existing heating and hot water systems, their controls, the fuel used and whether the property has a gas supply or an off-peak electricity meter.



### DEVELOPING AN AFFORDABLE WARMTH PROGRAMME

General improvement measures should be considered along with energy upgrading measures and the advantages taken (in both cost and simplification of installation) of combining the appropriate measures and activities. The Table opposite lists energy efficiency opportunities which should be at least considered when general improvements are planned.

### SETTING PRIORITIES

These priorities might include:

- Establishing a proportion of the maintenance/capital repairs budget to be set aside for initiating an energy improvement programme. A programme to bring all properties up to a set standard could be planned over say, a 10 year period and costed on an annual basis.
- Targeting the homes in greatest need, eg those with the highest heat loss, inadequate heating or expensive to use heating systems such as ceiling heating.
- Reviewing improvement and renovation practice as well as repair and maintenance work in the light of the heat loss targets and upgrading the specifications as necessary.
- Reviewing the window replacement programme. This might mean taking a decision that all replacement windows and doors should have good quality draughtproofing and be double glazed and that all windows should be provided with trickle ventilation in accordance with the requirements of the 1990 revision to Approved Document F1 (Building Regulations).
- Reviewing any heating improvement schemes with a view to replacing them with heating/insulation/ventilation packages. The package provided to each scheme should be tailored to tenants needs and priorities following consultation.
- Establishing links with Neighbourhood Energy Action schemes that can provide effective advice to tenants, as well as draughtproofing and loft insulation work.

As budgets get tougher and financial constraints more rigid, it becomes increasingly important to involve tenants in budgeting decisions when setting rents and service levels. Tenants should have information about the effect on rent of increasing, holding or cutting capital programmes so their concerns and priorities can influence these vital decisions. Sometimes the only way to develop a real programme is to increase rents, and if tenants have some control in setting priorities, they are more likely to understand and agree to any necessary rises for extra services and improvements.

Meaningful consultation would involve offering tenants an agreed menu of options, together with the corresponding rent levels. Ideally they should also have information about the fuel cost savings

### GENERAL IMPROVEMENT

Rewiring  
Refitting kitchens and bathrooms  
  
Repointing walls  
Repairing frost damaged brickwork or render  
Upgrading external environment  
Changing internal layout  
Repairing windows  
  
Repairing heating system  
  
Repairing cladding  
Repairing flat roof  
Replacing external doors  
  
Repairing ground floors

### POTENTIAL FOR ENERGY UPGRADING

Internal wall insulation  
Internal wall insulation  
Double glazing  
Cavity fill  
External wall insulation  
External wall insulation  
Internal wall insulation  
Draught stripping  
Replacement windows  
Double glazing  
More efficient or lower tariff system  
Smaller system for insulated dwelling  
Add insulation  
Add roof insulation  
Draught strip  
Insulated doors  
Porch or vestibule  
Floor insulation

### FINDING THE MONEY?

**Below are three suggestions.**

They are not mutually exclusive, an Authority could adopt all three as appropriate.

### Increase rent to pay for extra insulation work

This approach must be financially viable for the tenant. Any rent increase attributable to the insulation work should be less than the anticipated savings in the heating bill. When evaluating anticipated savings, it should be borne in mind that tenants with the lowest energy bills tend to take a larger part of improvements to energy efficiency in the form of increased temperatures rather than reduced energy bills.

Provided this is taken into account, a rent increase is an obvious possible solution, particularly when insulation is included as part of an overall improvement package which could imply a rent increase anyway.

### Install a cheaper heating system to offset the cost of insulation

Some councils are switching from full gas central heating systems to a 'modular' approach consisting of unit heaters combined with an insulation package.

The insulation package reduces heat loss to a level that individual heaters can provide the same design level of comfort (21°C in living rooms, 18°C elsewhere) as a standard gas system of boiler and radiators, but for lower capital cost and with lower running costs. This allows more properties to be upgraded within a set budget. What's more, tenants have been found to prefer the familiarity of the simpler controls on unit heaters to central heating programmers and room thermostats.

### Offset capital cost of insulation against future savings in revenue

This approach is mainly applicable to housing that has become 'run down' and/or presents serious and expensive on-going maintenance problems.

The Estate Action programme includes over 100 examples of "Affordable Heat" schemes where heating and insulation packages have formed an essential part of programmes to revitalise run-down estates.

likely to result from each measure. This will help them decide which options they can afford, as well as those which will benefit them most. Some

Local Authorities try to give individual flexibility, but for major improvements it may be necessary to gain a consensus from all the tenants affected.

## POST WAR LOW RISE HOUSING

### PRESENTING AND ANALYSING THE RESULTS OF THE SURVEY

The information from the energy survey should be presented in a way that makes it possible to see which properties need to be regraded to meet the set target.

### SELECT APPROPRIATE IMPROVEMENTS TO INSULATION, HEATING AND VENTILATION

This can be done using the BREDEM based software, such as Energy Targeter, or Energy Label programs from the National Energy Foundation (NHER Evaluator) and Starpoint (see Setting a Target P. 5).

A full package of energy saving measures will produce the best result:-

- Loft insulation (and roof ventilation)
- Wall insulation (internal or external)
- Ground floor insulation
- Replacement double glazed windows
- Adding porch or vestibule
- Replacement insulated draught stripped external doors
- Controlled ventilation including extract fans
- Whole house heating with insulated piping and cylinder

Where there are physical or cost constraints, particularly with regards to wall or floor insulation partial measures may be necessary and if carefully selected can achieve worthwhile savings but the risk of condensation should always be assessed.

The cost of improved insulation can often be partly offset by simpler and cheaper heating systems. When the design heat loss of a dwelling can be reduced to below about 5kW it is quite possible to provide whole house heating with unit heaters or a 'low energy' gas system as well as a conventional gas central heating system.

### MEASURES TO CONSIDER

The following are brief descriptions of energy saving measures available. All costs shown are for guide purposes only and are based on an average 3 bedroom semi-detached two storey house at January 1990 levels — unless otherwise stated.

#### WALL INSULATION

##### Cavity Fill

- the most cost effective method for traditional construction.
- exposure and height of building may restrict choice of type of fill.
- depending on cavity width, can save up to 20% energy annually.
- reduces condensation risk.
- little disturbance to tenants.
- need to have installation carried out by approved contractor.
- cost: approximately £200 for several dwellings treated together.

#### Internal Insulation

- next most cost effective method to cavity fill.
- suitable for any masonry wall but particularly for solid walls and walls to internal common access and stairs.
- particularly useful during internal alterations.
- can save up to 20% energy annually.
- reduces risk of condensation on wall surfaces.
- rooms heat up quicker.
- particular walls can be selected for internal lining.
- creates a major disturbance to tenants and generally requires decanting.
- cost: approximately £1,500.

#### External Insulation

- suitable for solid walls; walls where external face requires major repair; or where there are serious condensation problems due to cold bridges.
- can save up to 20% energy annually.
- reduces condensation risk.
- dwellings stay warm longer.
- can make a radical change to external appearance.
- work is all external but drilling may disturb tenants.
- cost: approximately £4,000.

#### PITCHED ROOF INSULATION

##### Glass or Mineral wool quilt or batts

- cost effective method.
- 150mm thickness can save up to 20% energy annually in typical 3 bedroom house.
- reduces condensation risk within house.
- loft space above insulation must be ventilated.
- cost: approximately £200 including provision of eaves ventilation.

##### Blown Wool and loose fill

- most cost effective method, but difficult to control and to ensure consistent thickness.
- useful for loft spaces with difficult access.
- 150mm thickness can save up to 20% energy annually in typical 3 bedroom house.
- reduces condensation risk within house.
- loft space above insulation must be ventilated.
- cost: approximately £180 including provision of eaves ventilation.

#### FLAT ROOF INSULATION

##### Insulation and water-proofing on top of existing roof

- lowest cost method and most cost effective if carried out when existing roof requires extensive repair.
- requires regular and continuing maintenance.
- 150mm thickness can save up to 20% energy annually for typical 3 bedroom house.
- reduces condensation risk.
- cost: approximately £1,700.

#### Construct new pitched roof

- high cost method.
- long life low maintenance.
- suitable if a major change in external appearance is acceptable or desirable.
- existing structure must be strong enough for new construction.
- insulation and energy savings as for pitched roof insulation.
- cost: approximately £4,900.

#### GROUND FLOOR INSULATION

Mineral wool quilt between joists in suspended timber floors

OR

Rigid insulation below screed in concrete solid floors.

- ground floor insulation only cost effective when floors are being replaced or extensively repaired, or where there is access from below.
- external edge insulation possible in conjunction with external wall insulation.
- can save up to 10% energy annually in typical 3 bedroom house.
- can reduce draughts.
- costs: existing suspended floor — £170. Existing solid floor — £730.

#### SPACE HEATING AND HOT WATER SYSTEMS

- Improved heating without good insulation will not save energy and will be costly for tenants.
- In a well insulated house a new heating system can be scaled down to give comfort standards at affordable running costs.
- System should be appropriate to occupancy; elderly house bound people need a different system from young working couples out all day.
- Controls must be easy to use.
- Hot water cylinders and circulation pipes must be lagged.
- typical costs: gas fired radiator system — £2,400. Electric storage heaters — £1,350.

#### WINDOWS

##### Double Glazing

- When window replacement is necessary double glazing is a cost effective method compared with single glazing.
- depending on area of window, can save up to 12% energy annually.
- reduces cold draughts.
- large glazed areas can be reduced in size, with replacement units.
- cost: approximately £2,300 (single glazed windows — £1,750).

#### CONTROLLED VENTILATION

- for replacement windows specify trickle vents.
- provide humidistat control extract fans for kitchens and bathrooms
- cost: approximately £500.



**CONTROLLING DRAUGHTS****WINDOWS****Draught Stripping**

- low cost short term method.
- only possible where existing frames are in reasonable condition.
- limited improvement to comfort standards.
- draught stripping without controllable ventilation may give rise to condensation.
- cost: approximately £110.

**DOORS**

Draught stripping external doors, see  
WINDOWS.

**Provision of porch or vestibule**

- more conveniently carried out during modernisation programme.
- reduces air infiltration and therefore raises internal temperatures.
- cost: external porch and door approximately £2,100.

**WHO TO CONTACT****TECHNICAL SERVICES DEPARTMENT OF  
YOUR AUTHORITY for**

- condition of stock
- feasibility studies
- costing and implementation

**BUILDING RESEARCH ENERGY  
CONSERVATION SUPPORT UNIT (BRECSU)**

- good practice guidance and case studies on energy efficiency in all buildings
- The Enquiries Bureau  
BRECSU  
Bucknalls Lane, Garston  
Watford WD2 7JR  
Tel: 0923-664258

**BUILDING RESEARCH ESTABLISHMENT  
ADVISORY SERVICE**

- current advice available.
- special studies of projects.
- assessment of energy saving and condensation risks.

Bucknalls Lane, Garston,  
Watford, WD2 7JR Tel: 0923-664664

OR

Scottish Laboratory  
Kelvin Road, East Kilbride  
Tel: 03552-33941

**ARCHITECTURAL OR TECHNICAL  
CONSULTANCIES for**

- feasibility studies
- costing and implementation

**LOCAL ENERGY PROJECTS**

- advice and installation of a range of energy measures
- energy audits

Neighbourhood Energy Action  
2-4 Bigg Market,  
Newcastle Upon Tyne  
Tel: 091 2615677

**ENERGY EFFICIENCY OFFICE**

- general advice on energy efficiency
- sources of further information

**EEO Regional Offices:****NORTHERN REGION**

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**BREDEM LEAFLETS AVAILABLE FROM  
BRECSU****Estimating energy costs and potential  
savings in housing.  
Information Leaflet 6****British Standard Code of Practice for  
energy efficient refurbishment of housing.  
Information Leaflet 7.****Energy assessment for dwellings using  
BREDEM worksheets.  
Information Leaflet 8.****Energy efficiency means warmer homes  
at no extra cost.  
Information Leaflet 11.****BREDEM SOFTWARE**

Energy Advisory Services Ltd  
The Old Manor House  
Hanslope  
Bucks MK19 7LS  
Tel: 0908 510596

**ENERGY LABELLING**

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Rockingham Drive  
Linford Wood  
Milton Keynes  
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MVM Starpoint Ltd  
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